

**REMARKS**

Claims 1-12 are pending in the Application. Claim 1 is independent. As an initial matter, Applicants thanks the Examiner for reviewing and accepting the previously submitted terminal disclaimer.

**Rejection Under 35 USC § 112, first paragraph**

Claims 1-12 were rejected as allegedly failing to comply with the written description requirement. Applicant respectfully traverses the rejection.

As an initial matter, Applicant wishes to point out that the present application is a continuation of and incorporates by reference USSN 08/760,933, now US Pat. No. 6,652,808, which patent claims priority to and incorporates by reference US Pat. No. 5,787,032 ("the '032 patent"). Reference to the '032 patent below may assist the Examiner in understanding Applicant's arguments.

The instantly claimed invention is directed to a method for forming multiple identity substrate material having first and second affinity sequences. For example, as described from paragraph [0196] to paragraph [0230] of the specification, said multiple identity substrate material is useful for optical storage, optical writing, and low density optical memory applications. More specifically, the affinity sequences of the claimed invention, which typically take the form of DNA polymers, attached to solid supports are capable of exhibiting multiple chromophoric responses, photonic energy transfer and quenching as demonstrated in Figures 6, 7 and 8 by following the exemplary steps depicted in Figures 9-22 or Figures 27-28.

Importantly, in contrast to the Examiner's contention, the invention is not limited to

specific DNA sequences. To the contrary, any sequence may be used so long as said selected sequences are capable of hybridizing to other sequences, including complementary sequences to which chromophores or fluorophores are attached, depending upon the intended application of the substrate. Designing appropriate sequences for use in the presently claimed invention is well within the knowledge of one of ordinary skill in the art. Indeed, it is not the sequences *per se* that are important to the instantly claimed invention, but rather the resulting substrates having multiple identities, as exemplified by multi-colored areas of said substrate.

Indeed, the '032 patent describes at length that conventional nucleotide units arranged in various sequences, using conventional pairing and conventional double-helix structures are preferably utilized. (See, e.g., '032 patent col. 10, line 20 to col. 11, line 35.) Analogous to the description found in the instant specification at paragraphs [0214] to [0226] and in Figures 22, 24, and 25, the '032 patent describes synthesis of 12 functionalized affinity sequences subsequently reacted with chromophores to yield 26 DNA-chromophore derivatives capable of displaying 8 distinct colors. (See, '032 patent col. 11, lines 6-35.)

Thus, contrary to the Examiner's contention, Applicant respectfully submits that one of ordinary skill in the art would readily appreciate that nearly any nucleotide sequence may be used to synthesize the multiple identity substrate described in the claims. Indeed, it is not the nucleotide sequence itself that imparts any color or hue to the substrate. (See, office action at paragraph 9.) Instead, it is selection of a sequence of a desired length attached to a particular chromophore or fluorophore that supports the color variation of the

multiple identity substrate of the claimed invention. Moreover, Applicant asserts that one of ordinary skill in the art would be able to discern the difference between a useful and non-useful multiple identity substrate based on the selected chromophore or fluorophore and the intended purpose of the substrate.

Accordingly, Applicant respectfully maintains that the specification complies with the with written description requirement and respectfully requests removal of this rejection.

The Examiner further contends that the specification does not comply with the written description requirement because the disclosed affinity sequences are not “used or useful in (1) creating molecular electronic and photonic mechanisms, (2) for the organization, assembly, and interconnection of nanostructures, submicron and micron sized components onto silicon or other materials, (3) for the organization, assembly, and interconnection of nanostructures, submicron and micron sized components within the perimeters of microelectronic or optoelectronic components and devices, (4) for creating, arraying, and manufacturing photonic and electronic structures, devices, and systems, (5) for the development of a high bit density (large byte) three and four dimensional optical data storage materials and device, or (6) for development of low density optical memory for applications in authentication, anti-counterfeiting, and encryption of information in documents or goods.” Applicant respectfully traverses this rejection.

As the Examiner states, the written description requirement mandates that Applicant convey with reasonable clarity that as of the filing date he was in possession of the invention. Such demonstration is depicted, for example, in paragraphs [0196] to [0228] and Figures 9-19, which describe use of the claimed multiple identify substrate material for

optical writing and storage. For example, the specification at paragraph [0199] describes four separate mechanisms by which information can be written into DNA substrate materials: (i) spatial UV inactivation of thymidines within DNA sequences; (ii) spatial UV inactivation of fluorophores and chromophores; (iii) spatial UV inactivation or activation of quencher chromophores; and (iv) spatial UV inactivation or activation of subsequent hybridization by crosslinking, particularly through the use of psoralens.

The specification continues with a description detailing how one of skill in the art could synthesize a substrate containing multiple identities, wherein each identity may be associated with a particular chromophore or fluorophore. (See, e.g., Figures 9-13, and Figures 6-7, which show images of affinity sequences exhibiting multiple chromophoric responses, photonic energy transfer, and quenching attached to a single substrate.) Moreover, the '032 patent is replete with examples and descriptions of optical storage using the multiple identity substrates of the presently claimed invention.

Accordingly, Applicant respectfully maintains that the specification complies with the with written description requirement and respectfully requests removal of this rejection.

**Rejection Under 35 USC § 112, second paragraph**

Claims 1-12 were rejected as allegedly failing to comply with the enablement requirement. Applicant respectfully traverses this rejection.

The specification of the instant application does, in fact, enable of ordinary skill in the art to use the claimed invention. For example, the specification, at paragraphs [0198] to [0214] recites a mechanism for DNA optical storage. In fact, the specification describes a two-step UV/psoralen write process. In addition, the specification provides a detailed

description and several figures exemplifying a two-color DNA write process. (See, e.g., paragraphs [0215] to [0228] and Figures 23-28.)

For example, Figures 9-19, describe a method for forming multiple identity substrate material. DNA containing psoralen compounds intercalated therein are capable of being crosslinked upon exposure to UV light. Figure 9 shows DNA sequences having a particular identity (A) covalently attached to a substrate that had been previously treated with APS to facilitate said covalent attachment. In Figure 10, a psoralen-modified sequence (B), which is complementary to sequence (A), is hybridized to all four quadrants of the substrate. A UV mask is then used to block quadrant 1, in Figure 11, while the other quadrants are exposed to UV radiation at 365nm, which causes the psoralen molecules to crosslink the (A) and (B) sequences.

In Figure 12, the entire surface is subjected to a dehybridization process, which allows the non-crosslinked (B) sequence to be removed from the (A) sequences in quadrant 1. As shown in Figure 13, the entire process is repeated with a sequence having identity (C), a portion of which is complementary to at least a portion of the (B) sequence. Figures 14-18 schematically demonstrate repetition of the process for quadrants 2, 3, and 4. Figure 19 shows that at this point in the process, the specificity of four sequences (A),(B),(C), and (D) can be verified by exposing the substrate to fluorescently labeled, complementary DNA sequences such that each quadrant fluoresces with its particular color if the process has been carried out properly.

In the second step of write process, as shown schematically in Figures 20, 21 and 22, an additional masking and UV irradiation exposure (at lower wavelength) can render

the DNA in the UV-exposed areas incapable of additional hybridization. For example, exposure to higher energy UV radiation can cause thymidine residues within the DNA sequences to dimerize, which has the ultimate effect of "turning off" those sequences. Thus, it is possible to selectively activate various portions of the substrate such that they are capable of fluorescing with different colors.

Moreover, the '032 patent, which is incorporated into the instant specification by reference, provides detailed structure, sequences and chemistry relating to optical storage using a multiple identity substrate of the claimed invention. (See, e.g., '032 patent col. 10 to col. 16.)

Accordingly, Applicant asserts that the specification satisfies the enablement requirement articulated in 35 USC § 112, first paragraph and respectfully requests removal of the rejection.

**Rejection Under 35 USC § 101**

Claims 1-12 were rejected as allegedly lacking either a credible and substantial or well-established utility. Applicant respectfully traverse this rejection.

Multiple identity substrate material, as described by the claimed invention, has both substantial and credible utility, for example, in the form of optical memory. Uses for such optical memory are described throughout the specification, including mechanisms for high and low density molecular storage. Those of ordinary skill in the art would know how to use the claimed invention because, for example, at least as early as 1994 when the '032 patent was filed, skilled artisans were conversant in methods of optical, molecular storage. Indeed, as early as 1987 those of skill in the art were adept at using DNA as a molecular

memory device. (See, e.g., Robinson et al., "The Design of a Biochip: A Self-Assembling Molecular Scale Memory Device" *Protein Engineering*, 1:295-300 (1987).) The device described by Robinson et al. utilized DNA in association with electron conducting polymers. (Id.)

Moreover, the Examiner's rejection does not comply with the statutory requirements for a rejection under 35 USC § 101. A proper rejection under 35 USC § 101 requires the Examiner must (a) make a prima facie showing that the claimed invention lacks utility, and (b) provide a sufficient evidentiary basis for the factual assumptions relied upon in establishing said prima facie showing. (See, *In re Folkers*, 344 F.2d 970 (CCPA 1965).) If the Examiner fails to develop a prima facie case and provide *evidentiary support* for the rejection, the rejection must be withdrawn. (See, *In re Gaubert*, 524 F.2d 1222, 1224 (CCPA 1975)("Accordingly, the PTO must do more than merely question operability -- it must set forth factual reasons which would lead one skilled in the art to question the objective truth of the statement of operability.").) In the instant rejection, the Examiner has not provided any evidentiary support that one of skill in the art would conclude that it is more likely than not that said asserted utilities are not credible, especially given the state of the art at least as early as 1987 when skilled artisans were already developing molecular memory devices. Accordingly, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

**Conclusion**

Applicant respectfully requests that the Examiner reconsider the claim rejections based on the foregoing discussion. Applicant believes the pending claims are allowable and respectfully requests a notice of allowability.

Respectfully submitted,

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